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STRATEGIC PLAN

DEFENCE RESEARCH ESTABLISHMENT

OTTAWA

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DEC 11 1992
Nepean, Ontario
CANADA

November 1992

105-02546/

DEFENCE RESEARCH ESTABLISHMENT

OTTAWA

STRATEGIC PLAN

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Defence Research Establishment Ottawa

Strategic Plan

1.0 Introduction, Organization, Vision & Uniqueness

1.1 Introduction

The purpose of this plan is to clearly document:

a. the mission and the research thrusts of the Establishment;

b. some of the issues and influencing factors that may have an effect on the work of the Establishment; and

c. action plans to be addressed in the future.

The chemical and environmental protection programs at Defence Research Establishment Ottawa (DREO) will be relocated to the Defence Research Establishment Suffield (DRES) and the Defence and Civil Institute of Environmental Medicine (DCIEM), respectively, by the summer of 1994. As a result, the future directions of this work have been excluded from this Strategic Plan.

1.2 Vision

The vision of DREO in 5 to 10 years is one of being recognized as a centre with a justifiable reputation for excellence in: providing scientific and technical leadership, satisfying military requirements through scientific research and development (R&D), strengthening Canadian industry, and being able to provide sound advice to the Canadian Forces (CF). This successful reputation will be built upon the competence of the staff, a directed focus of the R&D program within specific niches, a more direct control over the management of resources, an entrepreneurial approach to doing business, and a cognizance of the goals and visions of the clients. There will be close liaison with the clients, meeting often in a cooperative approach to solving problems and becoming indispensable to them. Success will be shown in the demand for expansion of activities. Because of this success, morale will be high and opportunities for the employees to grow and to prosper will expand. Any cost benefit analysis will reveal that DREO cost-effectively contributes to the mission of the CF and that it adds value to the Canadian economy.

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1.3 Organization

The Defence Research Establishment Ottawa is one of six research establishments within the Department of National Defence (DND). DREO is co-located with the Communications Research Centre (CRC) and the David Florida Laboratory (DFL) of the Canadian Space Agency on the Shirleys Bay site in Nepean, a few kilometres west of Ottawa. The work of the Establishment is currently performed within six divisions:

a. the Electronics Division is responsible for R&D in space-based communications and radar surveillance systems, navigation systems, and the protection of equipment and personnel against the effects of nuclear radiation, including electromagnetic pulse (EMP) effects and transient radiation effects on electronics (TREE);

b. the Electronic Warfare Division for R&D in radar countermeasures, radar electronic support measures, and communications electronic warfare;

c. the Protective Sciences Division for R&D aimed at providing chemical, environmental, and a balanced integrated approach to individual protection for Canadian Forces personnel. This Division will be disbanded by the summer of 1994 as a result of the consolidation of the program of activities at DRES and at DCIEM;

d. the Program Support and Telecommunications Liaison Division for the R&D programs operated within the Communications Research Centre on behalf of DND and to support general program planning and management;

e. the Radar Division for a broad range of R&D in surface, airborne, and spaceborne radar systems; and

f. the Administration Division for the management of the fiscal, personnel, and materiel resources, including procurement activities.

The structure of the support and administrative services within the Establishment is currently under review and is expected to be the subject of amendments.

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1.4 Uniqueness

DREO's uniqueness lies in a combination of its location, its special facilities and its skill sets. Proximity to the military operations staffs at National Defence Headquarters (NDHQ) facilitates, through frequent interactions, the understanding of Canadian Forces requirements and quick reaction to special needs. Location in the centre of "Silicon Valley North" facilitates the transfer of electronics based technologies to industry and the provision of support to the industry to ensure the success of this transfer. As well, joint projects between DREO and industry are more feasible because of the proximity to one another. The resulting synergy is beneficial to the program.

The technical skill sets within DREO are focused within the following technologies:

a. radar;

b. electronics;

c. electronic warfare;

d. communications;

e. command and control;

f. nuclear defence;

g. space based systems;

h. navigation; and

i. infrastructure support.

DREO has a number of facilities which are found in only a few locations within Canada and in some cases only at DREO. Among these are the following:

a. **EMP Facility** - This is the only facility of its kind in Canada for testing the effect of intense electromagnetic pulses on both military and civilian systems;

b. **Low Angle Tracking Facility** - The Radar Division has special facilities at the edge of the Ottawa River;

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c. **Shielded Room and SCIF** - The shielded room and the Sensitive Compartmented Information Facility are secure, RF (radio frequency) shielded workspaces for signal processing and storage of information classified up to Top Secret;

d. **DFL** - Through a collaborative program with the Canadian Space Agency ready access to the David Florida Laboratory space-craft integration and testing facility is available. In addition, DREO is a joint owner of such internal facilities as the small anechoic chamber and screened room facility for antenna studies up to 100 GHz;

e. **Nuclear Sources and Testing** - Various nuclear sources and test facilities, including the unique nuclear radiation evaluation mobile test van, are held;

f. **SATCOM Earth Station** - The station is complete with various antennas having an all-sky, high speed tracking capability and electronics operable in all satellite communication bands up to and including the 44 GHz band;

g. **NAVLAB** - The navigation lab is fully equipped for static and mobile testing of all navigation and related sensors and systems. It is unique in Canada for having high precision robotic motion platforms for inertial sensor work;

h. **Van de Graaf Accelerator** - It is capable of producing mono-energetic neutrons;

i. **EWESF** - The Electronic Warfare Engagement Simulation Facility is a secure, RF shielded, instrumented anechoic chamber in which "live" RF test measurements may be carried out. It is currently used for testing and evaluating non-coherent countermeasures against radar seekers; and

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j. **TASS** - The Tactical Signal Simulator is a hardware-based radar signal simulator capable, under computer control, of generating complex signal environments for the testing and evaluation of electronic support measures (ESM) systems and other types of receivers.

DREO has developed a unique set of skills as a result of its mandate, assigned responsibilities, and organization. Of the five divisions with scientific responsibilities (including the recoverable communications R&D program at the Communications Research Centre), four are involved in electronics research covering sensor systems, communications, space systems, and electronic warfare. These, when put together, represent a capability to address many of the technologies needed to support the evolution of communications, command and control information systems. This capability is well matched to the increasing demand for communications and information systems within both the military and other government departments.

All the divisions involved in electronics research have significant experience with data fusion as it is an integral part of their research effort.

DREO has a competence in space systems research which is not matched elsewhere within the Chief, Research and Development Branch (CRAD). It has previous experience with the Search and Rescue Satellite (SARSAT) and Radarsat systems, space based navigation systems, and has the current responsibility for research in support of two major space R&D projects: Space-Based Radar (SBR) and Extremely High Frequency Satellite Communications (EHF SATCOM). These projects have given, and continue to give, DREO staff experience in the management of major capital R&D projects with associated large industrial development contracts. Other work has provided the opportunity to deal with complete systems integration. Additionally, the proximity to the Canadian Space Agency facilities and the good working relations between the personnel facilitate the maintenance of space expertise.

The terrestrial communications R&D program is unique in that it is, in effect, provided under contract by the Department of Communications through CRC. While the research program is dedicated to military considerations, there are often synergistic civilian applications. There are a number of programs jointly staffed and funded, providing a significantly enhanced result to the CF and to Canadian industry. CRC has a special expertise in expert systems, having fielded the first expert system to be used by the CF, and is rapidly approaching the fielding of a second.

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The co-location of operational units provides an advantage in communicating and collaborating directly with members of the CF on problems of mutual interest. Currently there is one CF operational unit co-located with DREO, the SARSAT section. Soon this will be complemented by the creation of an Electronic Warfare Operational Support Centre (EWOSC) and several Integrated Support Stations (ISS). Locating the EWOSC in proximity to the DREO Electronic Warfare Division with its EWESF and SCIF facilities was deliberate and aimed at exploiting DREO's EW skills and expertise.

DREO also makes use of other unique facilities within the local area. The Radar Division uses two aircraft from the Institute for Aerospace Research, National Research Council (NRC) for flight testing radar systems.

2.0 Mission Statement - Defence Research Establishment Ottawa

Through our research and development activities we strive for excellence in providing scientific and engineering support to the Canadian Forces.

2.1 Purpose

The purpose of Defence Research Establishment Ottawa is to research, develop and exploit advanced science and technology to significantly enhance the operational effectiveness of the Canadian Forces.

The Defence Research Establishment Ottawa is the prime, and in certain technologies, the sole Department of National Defence research establishment with expertise and facilities in space systems, communications, electronic warfare, radar, navigation, and the protection of equipment and personnel from ionizing and non-ionizing radiation in the battlefield.

2.2 Method

The Chief of DREO is respqnsible for the program of R&D at DREO in direct support of CRAD for DND. The mission of DREO contributes to the mission of CRAD to which DREO will contribute in the most cost effective and efficient fashion possible. In addition, the Establishment will, to the maximum extent that is reasonable, exploit benefits to the Department that can be gained through cooperative arrangements and data exchanges with allies.

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By use of scientific and technical expertise established through research and development activities within the Establishment, Canadian industry and Canadian universities, the Defence Research Establishmen Ottawa will:

a. provide advice on scientific and technological aspects of defence operations and assist in the solution of technical problems arising in the operations of the Canadian Forces;

b. support the acquisition of materiel, whether by advice on the purchase of developed equipment, the modification or improvement of existing equipment, or the development of new equipment;

c. contribute to the sustainment of the Canadian Forces in times of military conflict;

d. anticipate scientific and technological advances and assess their impact on military effectiveness so as to reduce the danger of technological surprises in Canadian Forces operations and to benefit from advances;

e. contribute to the attainment of the overall national goals of the Government in the area of science, technology and industrial policy; and

f. collaborate with allies to share research and development resources and goals.

2.3 Values

The Defence Research Establishment Ottawa is committed to:

a. the maintenance of the highest standard of scientific and professional integrity and responsibility;

b. the establishment and maintenance of scientific excellence;

c. the promotion and maintenance of a Canadian defence industrial capability based upon the principles of excellence, competitiveness and timeliness of the product in the international marketplace and, the success of which contributes to the long-term defence and security of Canada;

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d. the support of all Canadian commitments wherever the Canadian Forces are deployed and the Department has need; and

e. the encouragement, development, and maintenance of the skills, expertise, capabilities and general well-being of all staff of the Establishment.

2.4 Clients

The work of the Defence Research Establishment Ottawa is performed for:

a. the Canadian Forces sea, land and air elements, as well as all strategic support units;

b. the Government of Canada and its departments, specifically, the Department of National Defence;

c. Canadian industry; and

d. the people of Canada.

3.0 Environmental Influences

The world is in a state of rapid and profound change. The Department of National Defence and all of its agencies, including DREO, are subject to multitudinous influences which have resulted in instability and uncertainty. These policy, military, economic, political, social and internal environmental influences are, indirectly or directly, of strategic concern to DREO.

3.1 Of significant influence is the Canadian Defence Policy which was published in April 1992 and sets forth a Canadian defence strategic policy based on current global political circumstances and defines the anticipated future roles of the CF in supporting this policy. The following defence priorities were enunciated:

a. defence, sovereignty and civil responsibilities in Canada;

b. collective defence arrangements with NATO and the U.S.; and

c. peacekeeping, arms control verification and humanitarian assistance.

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These priorities, as well as the following influences, will guide the strategic planning process for DREO.

3.2 Changes in the military environment which affect the Establishment include:

a. the end of the Cold War and loss of the traditional enemies of the past 45 years which have resulted in the lack of a clearly defined enemy and has removed a major focus for DND activities;

b. the diversifying role of the CF as a flexible, mobile force which may be called upon to go anywhere in the world with only short notice in order to respond to a diversity of situations requiring diverse technologies;

c. the reduction of Canadian Forces resources and requirements as a result of the restructuring of the CF and reduced spending initiatives by the government;

d. a trend towards integration of the militia into CF operational strategy where the results of R&D programs will have to be used easily by CF personnel who are part-time; and

e. the continuing trend to encourage the use, where possible, of capabilities within the commercial marketplace to support CF operations rather than to create separate systems.

3.3 Economic factors influencing DREO include:

a. the general lack of support by the public for military expenditure and the federal deficit resulting in pressures to downsize, decrease defence spending and generally reduce R&D spending;

b. a reduced affordability of services due to the economy and the high costs of major projects straining financial resources;

c. the shrinking industrial base including fewer defence products, increased international competition, and pressures to perform R&D in the industrial sector; and

d. globalization including common markets and U.S. policies for defence procurement.

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3.4 Political factors of concern are:

a. low public support for the military also experienced in defence R&D;

b. greater parochial and inward looking policies on the domestic scene limiting the creativity and expansion of new programs or ideas; and

c. global political uncertainty and a multipolarized world as evidenced in at least the following areas:

(1) Eastern Europe is undergoing a political, economic and military alliance upheaval. The upheaval that is under way creates a potentially unstable situation, especially in view of the very significant military resources that remain resident within the countries involved;

(2) in the area of the Middle-East, it is expected that conflicts will continue as will the threat of terrorist activity. Within this area of the world it is suggested that there is a threat from conventional weapons, chemical and biological weapons and possibly in the not too distant future, nuclear weapons; and

(3) the third world nations are expected to continue to require peacekeeping and aid-related duties and possibly to supply a destabilizing influence due to efforts to strengthen their infrastructures.

3.5 Social factors that influence possible CF requirements could include:

a. the increased concern and difficulties with the environment that could very well see the evolution of a new role for the Canadian Forces. (For DREO, the emphasis on protection of the environment, and compatibility of DREO's activities with such protection, will continue to be important. Receiving a clean bill of health in the environmental audit served to increase DREO's resolve to maintain its level of responsibility and citizenship.);

b. non-military radiation accidents, such as at a power plant explosion, which may require a potential role of the CF in clean-up operations in the aftermath;

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c. the changing social values affecting workplace relationships;

d. the changing demographics of Canada affecting the workforce pool;

e. the government's social policies, eg, Employment Equity and PS2000; and

f. the concern about the drug trade that could result in the CF being expected to be called upon to assist in law enforcement activities, such as drug interdiction.

3.6 At DREO, some of the internal factors are:

a. individual and segregated approaches to work;

b. current employment, recruiting, and reward systems;

c. rapid technological evolution and high competition which require new approaches to R&D;

d. a lack of a clearly articulated R&D policy and direction impeding a directed focus for the program; and

e. the increasing number of multi-disciplinary requirements that present challenges in efficiently using human resources.

4.0 Key Strategic Issues

Key issues that are expected to have a significant effect on the future of DREO have been identified. These strategic issues are defined as "make or break" issues which will directly affect the ability of DREO to succeed in the accomplishment of its mission.

The key strategic issues that have been identified for DREO include:

a. the rapidly changing international scene requires up-to-date acquisition of adequate threat information which is often not readily available;

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b. the continued reduction of available resources to perform R&D combined with the increased scrutiny of proposed R&D projects and the increased requirement for accountability;

c. the uncertainty of the changing times and the obstacles facing clients in determining their long-term needs make it difficult to respond quickly and appropriately;

d. the lack of awareness by Headquarters, DREO clients and the public of the expertise, capabilities, and products available from DREO;

e. the slow speed of the development cycle which prevents the accommodation of rapidly changing technologies;

f. the current methods of management of defence scientific career paths make it difficult to implement creative staffing strategies in a time of diminishing resources; and

g. the social and political realities of society are reflected in policies (official languages, employment equity, etc) to which there must be adherence.

5.0 Strategic Technology Thrusts

5.1 Selection Criteria

The program discussed in this section is based on three main functions which are strongly interrelated: applied research, systems development, and the maintenance of scientific expertise. Research develops the knowledge on which the systems development is based. Both the research and systems development activities contribute to the capability for providing advice to the CF. In addition to developing competence, the research at DREO is applied directly to solving CF problems. It is a resource which permits exchange with allies, and generates, assimilates and exploits new technologies for Canada. The systems development activity is oriented toward positioning Canadian industry for future military procurement. DREO advice enhances the "smart buyer" capability in DND, supports national and international negotiations and provides scientific expertise nationally or internationally.

As part of the strategic planning process, it is necessary to develop criteria which will allow DREO to select and recommend the "best" program elements. These

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criteria are consistent with those outlined in NDHQ Policy Directive P7/85. Among the criteria are projects that:

a. support the clients' current, future and potential needs;

b. have multiple applications;

c. enhance the Canadian industrial capability and are unique;

d. have a large economic impact compared to the CRAD resource expenditure;

e. are developmental where there is both a high probability of CF procurement activity and a high probability of Canadian industrial sourcing;

f. have interdepartmental and/or international support;

g. encourage the evolution of a technology not otherwise available to Canada and specifically to the CF;

h. provide the CF with operational benefits such as force multipliers or reduced life cycle costing; and

i. will involve collaborative R&D efforts with allies and with industry to stabilize programs and save resources.

The strategic plans of the individual DREO technical divisions are presented against the above mentioned technologies. Within each is a specific action plan. An action plan for strategic issues of concern to the entire Establishment follows.

5.2 Radar Division

5.2.1 Background

The Department's priorities demand a heavy reliance on radar both for surveillance and defence systems. Specific areas of major importance are airborne radar, ship defence systems, land-based coastal surveillance, spaceborne and airborne arms verification systems, the North Warning System, Low-Level Air Defence, space-based detection of air-breathing threats and the surveillance of space itself. Only radar can provide long-range, all-weather systems for these roles.

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5.2.2 Key Technology Thrusts

5.2.2.1 Surveillance technology thrusts include:

a. airborne and spaceborne very high resolution Synthetic Aperture Radar (SAR) systems; spaceborne pulse Doppler radars;

b. counter-countermeasures for SAR targeting radars, ship wake detection, operator-aided ship classification, novel SAR techniques: polarimetric SAR, interferometric SAR;

c. high rate integrated digital scan conversion and constant false alarm rate (CFAR) systems for non-acoustic anti-submarine warfare (ASW) radars;

d. high frequency surface wave radar for coastal and shipborne long range detection; and

e. air defence command and control: automatic target detection, automatic track initiation and maintenance, multi-radar track correlation.

5.2.2.2 Platform protection technology thrusts are:

a. pulse Doppler radar missile approach warning systems; and

b. HF surface wave shipborne radar, adaptive phased array shipborne radars.

5.2.2.3 Integrated fire control/search technology thrusts are:

a. electronic counter-countermeasures (ECCM) techniques for pulse Doppler radar, non-cooperative target recognition using jet engine modulation (JEM); and

b. adaptive phased array shipborne radars.

5.2.2.4 Multi-sensor integration technology thrusts are:

a. Ship anti-air warfare system, hybrid infrared (IR) radar missile approach warning system, air defence command and control.

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5.2.3 Strategic Considerations

The Radar Division and the radar technology field in total are the smallest in CRAD. This means that resources must be allocated very carefully to ensure the high priority needs of the CF are met. It means in some cases, requests for help must be turned down and, in others, only a modest forward looking technology-based activity may be carried.

It is necessary to continue to work closely with the existing client base, as well as contacting those who have historically been dealt with less, eg, the land elements. The work for the different elements must be carefully prioritized, based on the expected long-term industrial pay-off, to obtain long term support for the continuing existence of the program.

Canadian industry is fairly weak in the field of radar. There are some specialty areas, especially in signal processing, but there is very little expertise on the radio frequency side. This affects how to do business, and what jobs should be chosen. Projects that have a hope of exploitation in Canada should be chosen, and it must be done with a clear understanding of the state of industry.

The current geographical separation of the two sections in the Division at Shirleys Bay makes it difficult to foster close interaction among the members. This can reduce the effectiveness of the already small effort. As space becomes available at DREO, priority must be put on resolving this problem.

5.2.4 Action Plan

The actions to be taken are:

a. examine the current emphasis of the program to ensure it is meeting the customers' most urgent priorities;

b. continue and expand a program of visits by scientific and technical staff to operational command sites such as Cold Lake, Greenwood, Bagotville, and North Bay. Seek out what the operators' needs are;

c. strengthen existing, and establish new links with the Electronics and Electronic Warfare Divisions. Seek out opportunities for joint, mutually beneficial, experiments using available facilities within each division. Consolidate the two sections of the Radar Division in one location to foster more interaction;

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d. strengthen cooperative arrangements with other establishments, such as Defence Research Establishment Valcartier (DREV), DCIEM, and with the operational research divisions to take advantage of the combined expertise for solving system problems for the CF. Current examples are the Hybrid Missile Approach Warning System (MAWS) Project with DREV, the Air Command and Control Testbed, and in ship anti-air warfare;

e. strengthen ties with Air, Maritime and Land Engineering, and with requirements directorates;

f. participate in the space R&D planning activities now being spearheaded by Director Research and Development Communications and Space (DRDCS). Plan the future radar component of space R&D. Define the space-borne SAR research program as part of coordinated DND effort in space R&D;

g. shorten the development cycle time, so that continuity can be maintained and Canadian industry be given a competitive edge from these efforts. It is very important to not offer the same product, at possibly higher price, as external competitors. Exploit niches of expertise and in-country capability;

h. bring R&D efforts to product form. This should be the goal of the activity in the long term, no matter what the project. This "product" could have the form of a body of advice on procurement, fixing a problem, or it could be a system, either software of hardware, for the CF; and

i. emphasize succession planning. With a polarized work force of mostly very young or reasonably mature staff and very few in between, succession planning for future group leaders and section heads for the long term becomes more critical.

5.3 Electronics Division

5.3.1 Background

This Division has responsibilities which cover a wide variety of scientific disciplines: the effects of ionizing and electromagnetic radiation; navigation and satellite communication; and radar surveillance from space. Each discipline has a distinct community of interest and unique program influences, which complicate

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a consolidated strategic plan. The following paragraphs focus on several major issues which may be key to the survival of the associated programs.

Space is a milieu which figures strongly in most of the Division projects. To indicate this and to identify the primary location of CRAD R&D in space, the Division name will be modified by the addition of "Space Systems."

5.3.2 Key Technology Thrusts

The Radiation Effects Section (RES) has two major projects dealing with the effects of both ionizing and non-ionizing radiation on electronic equipment. The former is examining the increasing sensitivity of microelectronics to natural radiation, while the latter seeks to understand and minimize the penetration of high electromagnetic fields into electronic systems. In addition, RES has two minor projects concerned with the biological effects of ionizing radiation on personnel, radiation dosimetry, spectroscopy, and shielding.

The Communication and Navigation Section (CNS) houses one of the CRAD major capital projects, on EHF SATCOM. It conducts R&D on military SATCOM systems, technology, network architecture and signal processing techniques. Multisensor integration, an essential ingredient of modern navigation systems, is a key feature of the navigation program. Projects are also carried out in the associated areas of platform positioning and orientation.

The Space-Based Radar Section also is responsible for a CRAD major capital project, on Space-Based Radar. Through this project, expertise is being developed and maintained in CRAD and in Canadian industry in the systems and technology required for space-based surveillance. Emphasis has been placed on system analysis, electrical power, on-board signal processing, inter-satellite communication links, and large space structures.

5.3.3 Strategic Considerations

The possibility of a major nuclear conflict between the East and West has diminished significantly with the demise of the USSR. Although the spread of nuclear weapons to smaller, less stable countries reaffirms the ongoing need for a program covering the effects of a nuclear explosion, the perception exists that this need has been reduced.

Two major capital projects being managed within the Division will terminate in the next few years. Each is associated with a procurement activity identified in the Defence Services Program, but not yet having funding approval. Each has a possible technology demonstration phase, and possible international joint projects.

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5.3.4 Action Plan

The actions to be undertaken are to:

a. continue to make DND aware that nuclear defence must be addressed in terms of "risk", which is the probability of the event times the consequences. The probability of a nuclear explosion may be low but the consequences remain formidable, both to troops and equipment. Continue to identify that this program represents a capability not available elsewhere in Canada, and that the elements devoted to nuclear weapons effects are at minimum sustainable size;

b. prepare alternative ways-ahead for the possibility of positive or negative step functions in the SATCOM or space surveillance areas in terms of demands on Division personnel and resources. Continue to support the many national and international activities associated with these projects. These include the DND project offices and coordinating committees for space surveillance and for military satellite communications (MILSATCOM), the bilateral and multilateral (U.S., U.K.) discussions on surveillance technologies and flight demonstration, and the bilateral and multilateral (U.S., U.K., France) discussions on flight demonstrations and joint MILSATCOM procurement possibilities. Many parallel international activities are being pursued at this time since there is no clear picture as to which is the most likely to proceed and which will provide the greatest benefit to Canada. Continue the strong interaction with industrial partners; and

c. participate fully in the DRDCS initiative to define a coherent CRAD space R&D program. Examine alternatives for divisional organization to best match the customer's needs, the CRAD priorities, the divisional skills, and the complementary programs in other establishments.

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5.4 Electronic Warfare Division

5.4.1 Background

The Electronic Warfare Division has the responsibility within CRAD to support the CF requirements for the protection of maritime, air and land resources through the development and maintenance of a technology base in passive radar and communications surveillance and analysis techniques, and in radar and communications countermeasures.

Of specific relevance to EWD are the defence priorities summarized in the 1992 Defence Policy Paper which require the CF to develop and maintain the capability to:

a. conduct surveillance and to exercise control in all waters and airspace under Canadian jurisdiction;

b. assist the civil authorities, including fisheries protection and drug interdiction, and to participate in joint operations with our Allies; and

c. assist in arms control verification.

Implicit in these priorities is platform protection which is of concern to the Electronic Warfare Division.

The term 'Systems' will be added to the Division's name to indicate the increasing importance of an overall systems philosophy in the development of modern EW capabilities.

5.4.2 Key Technology Thrusts

The following technology thrusts have been defined with a view to satisfying the current and future requirements of the CF as defined in the Defence Policy Paper, together with related requirements of other law enforcement and surveillance agencies.

5.4.2.1 Electronic surveillance technology thrusts will lie in the areas of detection, localization and analysis of electromagnetic emissions. Specifically, emphasis will be placed upon:

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a. communications electronic support measures sensors:
   (1) detection of agile and wideband systems;
   (2) high accuracy direction finding (DF);
   (3) digital signal processing;

b. communications ESM information processing systems:
   (1) automated search/intercept;
   (2) data fusion and correlation techniques;

c. special applications:
   (1) detection of cellular and packet communications;
   (2) advanced signal processing techniques;

d. radar ESM receiver and device technology:
   (1) detection of low probability of intercept (LPI) signals;
   (2) high accuracy DF;
   (3) applications of intrapulse analysis; and

e. radar ESM signal/information processing techniques:
   (1) electronic intelligence (ELINT) database management;
   (2) advanced ESM processors.

5.4.2.2 Platform protection will be addressed through the development of electronic countermeasures (ECM) techniques and the analysis of platform engagements and through the integration of EW sensor/countermeasure suites. Emphasis will be placed on:

a. coherent radar countermeasures techniques:
   (1) coherent jammer technology;
   (2) coherent techniques generation;

b. non-coherent radar countermeasures techniques:
   (1) non-coherent techniques generation;
   (2) radio frequency (RF) signature measurement and control;

c. radar ESM/ECM systems integration:
   (1) engagement simulation;
   (2) EW control processors; and

d. communications countermeasures:
   (1) agile techniques;
   (2) improvement of existing systems.

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5.4.3 Strategic Considerations

In many ways the more ambiguous nature of the new CF responsibilities, compared to those of Cold War days, makes it difficult to define and carry out a long-term program of R&D with limited, and possibly diminishing, resources. There is no longer a monolithic, rigid, well-defined and relatively well understood threat target array. Instead there is a plethora of diverse, evolving, and poorly understood threats and responsibilities. The situation is complicated by the widespread use of western technologies by potential adversaries. These technologies are in many ways superior to those of the old Warsaw Pact but details are often, unfortunately, extremely difficult to obtain.

5.4.4 Action Plan

All aspects of EW Division activities will be examined to ensure the relevance of programs and the optimum use of resources. Specifically:

a. it will be necessary to examine more critically the ultimate pay-off of new international commitments such as TTCP and NATO. Before committing resources to new ventures, the value of the proposed collaborative effort to Canada and the CF will be more carefully assessed in terms of the magnitude of the expected resource contributions;

b. collaboration with other establishments will be emphasized and current and future areas of collaboration will stress the systems aspects of almost all military R&D underway today. There are also a number of DND and non-DND agencies involved in various aspects of electronic surveillance. Further efforts will be made to develop complementary, non-overlapping R&D programs with these agencies in areas of mutual interest;

c. all future program proposals will address the issue of inter-Divisional collaboration. Existing programs will be reviewed to determine where improved collaboration is possible;

d. there is increasing recognition that hardware and software developments within various parts of the EW Division itself do not take place in isolation. Where appropriate, the systems aspects of all Division programs will be a factor in determining the nature of the resources required to support the program;

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e. in-house programs will, where appropriate, take the form of technology demonstrators based on a short development cycle (SDC) philosophy. This approach, in which project development is based upon an iterative, evolutionary approach, has the advantage of incorporating customer requirements based on experience and of providing enhanced visibility of Division programs within industry and the CF; and

f. new initiatives, to be defined in detail in a DREO Industrial Strategy, are being defined in the following areas:

(1) contracting-out of EWD technical base activities;

(2) contracting-out of EWD development activities;

(3) EWD/Industry collaborative programs;

(4) industrial use of EWD facilities;

(5) contracting-in;

(6) technology transfers to industry; and

(7) software development.

5.5 Defence Communications Research Program

5.5.1 Background

The mission of the defence communications research program, usually referred to as the Recoverable Program, is to improve the CF communications capability through research and development. It is a program of research conducted on behalf of DND by the Communications Research Centre of the Department of Communications.

The program comprises a core element of work which includes activity in microelectronics, propagation and communications in the Extremely Low Frequency (ELF) through Extremely High Frequency (EHF) bands and in multi-mode communications networks. In addition, the program includes work in the ECCM and MILSATCOM areas which are part of broader based efforts within DREO proper.

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Reductions in R&D spending will effect the ability to support CF requirements for R&D in all areas of the program.

5.5.2 Key Technology Thrusts

Increased accountability and constraints on defence spending, human resources and equipment have combined to strengthen the need for improved information systems. This trend is considered to be long term and will lend emphasis to the need for improved communications. A large part of the burden of information flow is expected to be carried by existing or improved commercial systems but the need to provide secure and robust forward and rear links to mobile elements will continue to require alternates to land line/microwave systems. As well, the demand for increased information for decision making will drive technology to resolve the problems of systems compatibility and will require strong systems integration capabilities.

There is a well developed microelectronics and communications industry in Canada which can develop and produce equipment to satisfy many of the communications needs of the CF. The need to strengthen this capability through industrial transfer of the program's output and products will be a priority.

The requirement to provide advice on equipment choices for the CF will require a technology base designed to provide expertise and experience in a broad range of areas.

An increase in the proportion of work done in the program and in all areas of communications has migrated to the development of software versus a previous, heavy emphasis on hardware development. Microelectronics development and the development of technologies in the areas of neural networks and expert systems have also had an influence in the direction of the programs. The technology areas of optics and optical computing have also heavily influenced the future designs of highly integrated and physically demanding systems.

5.5.3 Strategic Considerations

Both the short-term and long-term programs must:

a. be relevant to, and satisfy, military needs;

b. enhance the unique scientific and technical skills of the staff; and

c. collaborate with industry as per the DREO industrial strategy to provide a positive result.

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5.5.4 Action Plan

The short term action plan is to develop a research program to match the resource levels defined for FY 93/94 and FY 94/95. To do this, it is necessary to:

a. review military requirements;

b. review major military plans;

c. prioritize client requirements in keeping with technology trends and opportunities as they relate to the defence environment of the 90s;

d. decide what is profitable and cost effective; and

e. implement imposed reductions.

The long term action plan is to develop a program which meets the needs of DND, other departments and industry and which has adequate safeguards to guarantee its survival. To ensure this, the following actions will be taken:

a. Review the research program with respect to:

(1) the CRAD/DREO R&D Industrial Strategy;

(2) a balance between research and development, and in-house and contracted-out work;

(3) the degree of satisfaction of military clients;

(4) involvement with government and industrial clients; and

(5) technology trends and opportunities.

b. Modify the existing program to ensure that:

(1) there is an industrial pay-off to help support the program;

(2) the development of unique skills are not provided elsewhere within CRAD;

(3) there is an ability to adapt to changing conditions and new CF missions; and

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(4) a mutually agreed level of support for the Electronics and Electronic Warfare Divisions is established by adopting a team approach.

5.6 Administration and Support Activities

5.6.1 Background

DREO is a self-accounting operational unit within the Department. Infrastructure support personnel are responsible for ensuring the sound management of the human, accommodation, financial, information, and materiel resources of the Establishment. They are also responsible for providing technical support regarding computer services, model shop prototyping, photography, publications, and technical liaison. This multitude of tasks is addressed through the provision of functional advice to line managers, as well as through direct operational transactions.

Infrastructure support, in the forms of resource management and technical support activities, is a central service provided to all people working at, or connected with, the Establishment. The main client groups are DREO Divisions, DND Headquarters, other government departments, industry, and institutions of higher learning.

DREO suffers from an aging infrastructure and the complicating factor of acquiring maintenance and services from another government department, the Department of Communications. An extensive plan for the creation of new buildings and renovations was produced and incorporated into an overall site plan. With the announcement of the departure of the Protective Sciences Division, the need for space has been changed significantly. Now the focus must turn to the decommissioning and renovation of existing buildings.

5.6.2 Strategic Considerations

Planned reductions to support staff over the next decade will create challenges in providing comparable levels of service to the scientific staff.

Information technologies are changing at a rapid pace and promise to change the ways in which we access and use information. The Establishment has the combination of support service personnel which can develop information management systems to the benefit of both management and scientific efforts.

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5.6.3 Action Plan

The plans for administration and support services are to:

a. review support functions within the Establishment with a view to maintaining the current level of service or to balancing support services with other resources and the technical program;

b. streamline the functions and accountability of the organization;

c. liaise with administrative and support counterparts in other Establishments to share costs and adopt coordinated procedures to preserve resources;

d. devise a plan which will involve the renovation of existing buildings to support the technical programs at DREO for the next 40 years;

e. examine the needs for information management systems and devise a plan for the integrated use of information resources within the Establishment; and

f. monitor the impact of the PS2000 changes to the classification of support staff and the potential effects during the rewriting of the General Services Group (GE) classifications.

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6.0 Establishment Action Plan

Action	Responsibility	Target Date	Strategic Issues
a. To create and review divisional workplans annually both as input into, and a result of, the Establishment strategic plan.	Directors	Review Nov 1993	a,b,c,d
b. To create a draft industrial strategy plan to assist in the development of a Canadian industrial capability which encompasses various approaches according to the specific characteristics of the technologies.	SA/CDREO and committee	Draft 1 Feb 1993	a,b,c,e
c. To enhance internal and external awareness of DREO activities by proposing appropriate solutions in a communications plan and implementing proposals.	SA/CDREO	Plan due 31 Mar 1993	c,d
d. To institute a career development initiative which identifies individuals with management potential and encourages their development and which is a part of an annual succession plan.	Management Team (Chief, Directors, SA/CDREO)	Assess-ment Mar 1993	f
e. To incorporate the principles and goals of the Employment Equity program in staffing positions with the intent of obtaining the most suitable candidates.	Management Team	Assess-ment Nov 1993	g

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Action	Responsibility	Target Date	Strategic Issue
f. Devise a detailed plan for the enhancement of bilingualism within the Establishment.	Management Team	Plan 31 Mar 1993	g
g. To facilitate the harmonious transfer of personnel to DRES and to DCIEM.	Chief and D/PSD	Summer 1994	
h. To consider the need for a software strategy for the Establishment.	Management Team	1 Feb 1993	b
i. To develop and implement a fast track "non mil spec" development cycle.	Directors	Reporting Nov 1993	e
j. To explore entrepreneurial methods of enhancing collaboration with outside users.	Management Team	Mar 1993	b

7.0 Success Indicators

It is often very difficult to determine at any particular point in time if a specific R&D project has been "successful". The benefits from a project may be recognized immediately, in the long term, or not at all (the benefit being simply being ready when required). This last point is highlighted in the Mission Statements for CRAD and DREO. The prime reason for CRAD's existence is the provision of sound scientific and technical advice to the Canadian Forces and the Department. Indeed, in measuring the success of the program at DREO it is necessary to refer back to the Mission Statement, and in each of the technology areas and general operations to determine the success in the maintenance of the "values" and in achieving the objectives. In addition, it must be continually determined whether the objectives and values remain valid.

The success of DREO is indicated by the degree to which:

a. sound technical and scientific advice have been provided to the Department and the Canadian Forces;

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b. suitable and sound technical and scientific resources have been created to meet the needs of the Department and the Canadian Forces;

c. new equipments that are needed, effective and cost effective have been successfully introduced into service;

d. in times of emergency, the response has been timely and there has been a positive contribution to the sustainment of the Canadian Forces;

e. technological and scientific advances of value to Canadian Forces and Departmental operations have been anticipated and evaluated;

f. a valued contribution has been made to the economic development and well being of Canada;

g. DREO Scientists are recognized as having a high professional competence and standard both in the national and international communities;

h. there a good sense of pride and accomplishment, and a general feeling of well being and good morale within the staff of DREO; and

i. the Strategic Plan has resulted in a visible, vibrant, and valued R&D plan for DREO.

It is recognized that these criteria may not lend themselves to easily to numerical quantification but that within them are the true indicators of the success of the R&D program of activities at DREO.

8.0 Concluding Remarks

The DREO Strategic Plan is a working and living document which reflects a process. It must evolve with time and be changed to reflect the changing world, the successes, and the failures. It is intended that this document be reviewed and updated annually.

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9.0 Glossary of Terms

ASW	Anti-Submarine Warfare
C^2	Command and Control
C^3	Command, Control and Communications
CF	Canadian Forces
CFAR	Constant False Alarm Rate
CRC	Communications Research Centre
CSA	Canadian Space Agency
DF	Direction Finding
DFL	David Florida Laboratory
DIR	Defence Industrial Research
ECCM	Electronic Counter-Countermeasures
ECM	Electronic Countermeasures
EHF	Extremely High Frequency
ELF	Extremely Low Frequency
ELINT	Electronic Intelligence
EM	Electromagnetic
EMC	Electromagnetic Compatibility
EMP	Electromagnetic Pulse
ESM	Electronic Support Measures
EW	Electronic Warfare
EWESF	Electronic Warfare Engagement Simulation Facility
EWOSC	Electronic Warfare Operational Support Centre
GE	General Services Group
HF	High Frequency
HFSWR	HF Surface Wave Radar
HPM	High Power Microwave
IR	Infrared
ISS	Integrated Support Station
JEM	Jet Engine Modulation
LPI	Low Probability of Intercept
MAWS	Missile Approach Warning System
MILSATCOM	Military Satellite Communications
NAVLAB	Navigation Laboratory
NCTR	Non-Cooperative Target Recognition

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NDHQ	National Defence Headquarters
NORAD	North American Air Defence
NRC	National Research Council
RF	Radio Frequency
SAR	Synthetic Aperture Radar
SARSAT	Search and Rescue Satellite
SATCOM	Satellite Communications
SCIF	Sensitive Compartmented Information Facility
SBR	Space Based Radar
TASS	Tactical Signal Simulator
TTCP	The Technical Cooperation Program
TREE	Transient Radiation Effects on Electronics

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TITLE:(U) STRATEGIC PLAN

CORPORATE AUTHOR: Defence Research Establishment Ottawa, Ottawa ONT (CAN)

ABSTRACT:

DESCRIPTORS: (U) National defense;Armed forces (Canada);Research management;Defence programmes;Planning;Research projects;Strategic analyses;Forecasting;Science;Materiel

IDENTIFIERS: (U) Strategic planning

REPORT DATE: 01 Nov 1992 **NUMBER OF PAGES :** 32

DRDKIM N°: 96-03337 **CANDIS N°:** 499931 **Format(s):**Hardcopy;Document Image stored on Optical Disk

Date modified: 2003-04-17 Important Notices